TAXONOMY OF THE GENUS POLYGALA SERIES DECURRENTES (POLYGALACEAE)[1]

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ABSTRACT

A taxonomic revision of POLYGALA series DECURRENTES is presented, based upon evidence from morphology, chromosome numbers, habitat, and distribution. Seven species, one with two varieties, are recognized. All are native to the southeastern United States. Each species is illustrated with line drawings showing habitat and floral morphology; distribution maps indicate sites of known populations. Selected specimens are cited, representative of the 2,463 examined. POLYGALA BALDUINII var. **carteri** (Small) Smith & Ward is proposed as a new combination, and POLYGALA **smallii** Smith & Ward is proposed in place of the illegitimate *P. arenicola* Small.

The genus *Polygala* L. is widely distributed in the tropical and temperate regions of the world. It is absent only in New Zealand, Polynesia, and the arctic regions of North America and Asia. Approximately 475 species of *Polygala* have been described; of these, 127 species occur in North America, excluding the Caribbean, with about 50 in the United States. Series *Decurrentes*, a natural grouping of seven species of the Southeastern Coastal Plain, known by Small (1933) as the genus *Pilostaxis* Raf., is here revised.

The numerous species in the genus *Polygala* exhibit a morphological diversity that is accommodated only by the use of hierarchical subgeneric classification. Three ranks may be usefully recognized below the level of genus and above that of species. Chodat (1893, 1896) divided the North American species into four sections, the largest of which is his *Orthopolygala*, containing the type of the genus (*P. vulgaris* L.) and now under Art. 22 of the International Code known as sect. *Polygala*. This section is characterized by the presence on the abaxial petal (keel) of a lacerate or fimbriate crest, and by sepals that persist in fruit. Within sect. *Polygala* Chodat recognized three subsections, two of them found in North America, and weakly distinguished by the degree to which the cells of the capsule are margined or winged. Those species with unwinged capsules or with the two cells narrowly and equally margined were placed in subsect. *Apterocarpae*, again the largest taxon. Within this subsection Chodat described several series, among the most natural of these being ser. *Decur-*

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rentes, in which the sepals are decurrent, forming narrow wings along the pedicels and onto the adjacent inflorescence axis.

The first species of *Polygala* ser. *Decurrentes* to bear a legitimate name was *P. lutea* (1753), typified by two slender plants received by Linnaeus from Peter Kalm, his correspondent and agent in the New World. Kalm undoubtedly made his collection near Swedesboro (then Raccoon), New Jersey, his home in the spring of 1749, and close to the northern limit of this most far ranging member of the series. Other species were described by Thomas Walter (1788) from the vicinity of his rice and indigo plantation on the Santee River, Berkeley County, South Carolina (*P. cymosa*), by Andre Michaux (1803) from a moist meadow in the Carolinas (*P. nana*), by Thomas Nuttall (1818) from a specimen received in correspondence from near the mouth of the St. Mary's River, northeastern Florida (*P. balduinii*), by Stephen Elliott (1822) from coastal South Carolina (*P. ramosa*), by A. W. Chapman (1887) from Tampa Bay, western peninsular Florida (*P. rugelii*), and by J. K. Small (1905) from pinelands near Cutler, Dade County, Florida (*P. smallii*).

These species were not immediately recognized to constitute a natural grouping within the genus *Polygala*. Nuttall revealed some awareness of relationships by arranging three of the four species treated by him in one numerical sequence, although *P. lutea* was placed separately. Elliott was familiar with five species which he listed consecutively but otherwise without separation from other members of the genus. DeCandolle (1824) treated *P. lutea* and *P. nana* apart from the other species now in the *Decurrentes*, and Torrey and Gray (1838), also not completely aware of the naturalness of the group, did likewise.

Rafinesque, again a resident of Philadelphia after his self-imposed exile to pioneer Kentucky, but still an outcast from the scientific community, first gave nomenclatural recognition to a grouping of the above species. His genus *Pilostaxis* (1838) contained only *P. lutea*, designated as the type, and *P. nana* (which he saw as two species), and was superficially or even erroneously characterized by capitate inflorescences and stamens in 4's (rather than 6-8's). Perhaps more for reasons of hauteur by the botanical establishment than from awareness of the inadequacies of his treatment, Rafinesque's *Pilostaxis* was disregarded for nearly one hundred years until disinterred by Small (1933).

It remained for the versatile Swiss botanist Robert Chodat, then rising through the ranks of the University of Geneva and wholly isolated from living North American *Polygala*, to recognize (1893) that several of the species often placed together on general appearance, shared the characteristic of sepals that were decurrent on the pedicel. He placed the species with this property in his series *Decurrentes*. But the equally astute Blake (1924), an American with field experience, although continuing the close placement of these species, gave the group no formal designation. Recent workers with

the Polygalaceae in the southeastern United States have given little attention to subgeneric divisions within *Polygala*; Saulmon (1971a, 1971b) followed Blake, and Miller (1971) was content to note that the *Decurrentes* of Chodat contained "clearly related species."

Recognition of infrageneric groups must always be subjective, and at times because of uncertain relationships elsewhere in a genus, one is tempted not to name even the more distinct aggregations. Since the time of Chodat, however, there has been general agreement as to the evolutionary homogeneity of the *Polygala* species with decurrent sepals. Although the features which unite the group are not of a magnitude to confirm the judgment of Rafinesque and Small that these species constitute a recognizably distinct genus, their structural similarities, supported by their common range on the Southeastern Coastal Plain and uncontradicted by the constancy of their chromosome numbers, seems justification for formal recognition at a lower level. Designation with the rank of series, as *Decurrentes* Chodat, is an appropriate means of inserting this group at a suitable level in the genus *Polygala*.

A total of 2,463 specimens from 12 herbaria was examined during this study. Lending institutions were: BUS, DUKE, F, FLAS, FSU, GA, MO, NCU, NSC, NY, PH, US. Distribution maps and specimen citations omit collections beyond those necessary to give indication of range.

MORPHOLOGY

HABIT. Plants of the series *Decurrentes* are all herbaceous, either erect or ascending, glabrous, and may appear succulent, particularly in the rosette stage. Their size varies from about 2.5-3 cm, a minimum height of *P. smallii*, to 11 dm, a maximum height of *P. cymosa*. The stems are round and smooth, or ridged. Most species may be either annual or biennial. *Polygala ramosa* appears to be consistently annual. *Polygala lutea* at least occasionally may be perennial, as was concluded by Holm (1929) following a three-year study. The biennial characteristic is readily revealed by the formation of a leafy rosette one year, then a stem with flowers the second year. No species exhibit a rhizome.

Reproduction is solely by seed. Since the flowers are small and the inflorescences often densely crowded, the number of seeds produced is high.

ROOTS. The root systems of the series vary from fibrous to tap-roots. *Polygala cymosa* has fibrous roots, while *P. nana* and *P. smallii* develop tap-roots. The rest of the species may have either, depending on the age of the plant and perhaps the influence of environment.

The root system customarily has a wintergreen-like odor, a frequent condition throughout the genus *Polygala*. This fragrance gives these plants the common name of "candy-weed" or "candy-root." All species have a strong or fairly strong scent except *P. cymosa*, which has little of this characteristic odor.

LEAVES. The species in this series show two major types of leaves, basal and cauline. A basal rosette is found in all species; however in *P. ramosa* and *P. balduinii* the leaves are usually withered by anthesis. Except for *P. cymosa*, the leaf shape is of an obovate-spatulate type which gradates upward to an elliptic-obovate shape. *Polygala cymosa* has long, broad, linear-lanceolate leaves in the basal rosette that abruptly change to widely spaced cauline leaves which are narrow and much smaller.

INFLORESCENCE. The inflorescences are of two recognizable types. One is the thick capitate raceme as found in *P. rugelii, P. lutea, P. nana,* and *P. smallii*. The other is a cymose panicle with racemose branches as in *P. cymosa, P. ramosa,* and *P. balduinii*. The branches may be dense as in *P. balduinii* var. *balduinii* or very loose as often occurs in *P. balduinii* var. *carteri*.

BRACTS. Each flower is subtended by one small and two minute bracts. In the species that have cymose inflorescences, the bracts are persistent. In the thick head-like racemes the bracts are deciduous, except in *P. nana* where they are usually deciduous but sometimes persistent.

FLOWERS. Flowers of the genus *Polygala are* zygomorphic and perfect. The calyx consists of a whorl of five free sepals. The two lateral sepals (wings) are large and petaloid and prominently project from the sides of the floral structure. These wings are orange, yellow, or yellowish in all species except *P. balduinii* in which they are white. The other three sepals are definitely sepaloid, the upper one being somewhat larger than the two lower ones.

The corolla is more specialized than the calyx. In this series it consists of three petals, two upper and one lower. The two upper petals are connate to the lower one but not to each other. One of the upper petals overlaps the other, forming an involute tube. The lower petal (keel) is distinctive, consisting of a blade which terminates in a hood-like flap (lamella) that partially encloses the reproductive organs. The outer surface of the lower petal bears a fimbriate or lobed extension (crest) that in size, shape and number of lobes is variable and is rather characteristic for each species. The corolla is deciduous upon maturation of the capsule.

The androecium consists of eight stamens in all species except in *P. nana* where there are usually six, although occasionally seven were observed. The general structure of the stamens is the same in all species. Each filament is adnate to the keel almost to the anther, the degree of adnation varying slightly with species. The anthers are all one-celled and when mature dehisce by a single oblique apical opening.

The gynoecium is characterized by a deciduous style which bifurcates in a vertical plane, with the ventral lobe curving distally upward. Both stylar lobes thus appear dorsal to the axis of the style. The distal stigma is tufted with long once-forked hairs. The proximal stigma is indument-free and is closer to the stylar axis. The ovary is two-celled and superior. Both cells are

functional, each containing one ovule borne on the distal portion of the septum.

FRUITS. All species have two-celled, wingless, thin-walled capsules. The locules are in the plane of the stylar lobes, each dehiscing by a single long loculicidal suture.

SEEDS. One seed is produced in each cell. Seeds in this series are lightly pubescent with the exception of *P. cymosa*, which is glabrous. A blunt rostrum may be present at the base of the seed. The size and shape of both the seed body and the aril are usually distinct for each species.

CYTOLOGICAL INVESTIGATION

Considering the size of the genus *Polygala*, there have been very few publications concerning chromosome studies. Only Lewis and Davis (1962) have published a *Polygala* cytology in the New World. They have also summarized the earlier work of Old World authors.

Lewis and Davis were impressed with the striking diversity of chromosome numbers encountered. They suggested a basic number of $x \pm 17$ for the section of the genus in which ser. *Decurrentes* occurs. They specifically reported *P. lutea*, *P. nana*, *P. ramosa*, and *P. rugelii* as having gametic counts of 34. These figures are in conflict with all counts obtained in the present study.

In all species of the series *Decurrentes* (excluding *P. smallii*, which was not counted) the gametic numbers here observed were 32. In the single species where a successful somatic count was obtained (*P. lutea*) the chromosomes numbered 64. Voucher specimens are recorded in Table 1. All chromosomes were small and without apparent differentiation.

TABLE I

CHROMOSOME NUMBERS OF POLYGALA SER. DECURRENTES

All counts were made from Florida materials. All vouchers are deposited in FLAS.

Taxon	*2n*	*n*	Source
P. cymosa		32	Clay Co., 3 mi. n. of Gold Head Branch State Park, *Smith & Myint 70.*
P. ramosa		32	Union Co., 3.8 mi. s. of Lake Butler, *Smith 94.*
P. balduinii			
var. *balduinii*		32	Lee Co., 7 mi. e. of Ft. Myers, *Smith 380.*
var. *carteri*		32	Dade Co., in glade adjacent to Long Pine Key, Everglades National Park, *Smith & Buchanan 103.*
P. rugelii		32	Pinellas Co., w. of 14th St., St. Petersburg, *Smith 160.*
P. lutea	64	32	Alachua Co., 6 mi. n.e. of Gainesville, *Smith* (10 Apr. 1961).
P. nana		32	Alachua Co., 6 mi. n.e. of Gainesville, *Smith* (10 Apr. 1961).

GEOGRAPHICAL DISTRIBUTION AND ECOLOGY

Representatives of the series *Decurrentes* are distributed along the Coastal Plain from New Jersey to Florida, westward to Texas, with *P. balduinii* var. *carteri* extending to Cuba. Their usual habitat is the moist to wet pine-barrens, pine-flatwoods, pine-palmetto associations, or open grassy savannas. *Polygala nana* and *P. smallii* also inhabit drier areas, the latter being found only in the dry sandy pine-palmetto areas of South Florida. Most of the species are able to withstand considerable competition, but *P. nana* and *P. smallii* are usually found in microhabitats of open areas void of other plants.

The over-all distribution of series *Decurrentes* indicates the southeastern United States as a point of origin. The lack of a fossil record makes impossible any certain knowledge of the age of the group, but the similar distribution of the various species strongly suggests an origin not too far in advance of the Pleistocene. The morphological diversity of the series is much greater than one might anticipate to develop in the relatively brief period since the Pleistocene.

During th Pleistocene epoch much of the area now occupied by members of the series *Decurrentes* was at least temporarily submersed (James, 1961). But islands and archipelagos isolated from the continental mass would clearly provide conditions under which divergent evolution and, ultimately, speciation could take place. Such opportunities may well have been responsible for some of the morphological diversity found in the *Decurrentes*.

Polygala lutea, P. nana, P. ramosa, P. cymosa and *P. balduinii* var. *balduinii* are relatively uniform throughout their ranges northward up the Coastal Plain and westward along the Gulf Coast. Their distribution either was not broken by Pleistocene flooding or, if broken, did not lead to morphological diversity. There is no reason to speculate that they have had any recent history more complicated than survival in the continental southeastern United States during Pleistocene flooding, followed by migration into the newly exposed Coastal Plain and Gulf Coast.

Polygala rugelii, limited in range to the Florida peninsula and yet adapted to the same habitats as some of the above more widely ranging species, suggests a different history. Its distribution may perhaps best be explained by the assumption that its pre-Pleistocene range was restricted to the area of the Florida peninsula and that the species survived only on the Pleistocene islands from which it had since spread.

The two remaining taxa suggest perhaps a third mode of origin. *Polygala balduinii* var. *carteri* and *P. smallii* show very close relationships to *P. balduinii* var. *balduinii* and *P. nana* respectively. Their morphological differences may result from Pleistocene isolation in a manner similar to that suggested for *P. rugelii*, but with the more widely distributed member of each pair surviving also on the mainland and since spreading into the

newly exposed peninsula. However, it seems at least equally probable that these two taxa have resulted from a post-Pleistocene isolation by adaptation to the special habitats of South Florida.

SYSTEMATIC TREATMENT

Series *Decurrentes* Chod., Mém. Soc. Phys. Genève 31 (2)[2] :125. 1893.
Pilostaxis Raf., New Fl. N. Am. 4:88. 1838.
Type species: *Polygala lutea* L. (selected by Rafinesque, 1838)

Annuals, biennials, occasionally perennials. Root system fibrous or taproot. Stem erect to ascending, single or several, smooth or ridged. Basal leaves spatulate (gramineous in *P. cymosa*), usually thick. Cauline leaves alternate, entire. Stipules absent. Inflorescence a capitate raceme or a cymose panicle. Flowers yellow, orange, or white to greenish-white. Sepals 5, decurrent on pedicel and on inflorescence axis; lateral sepals (wings) large, petaloid. Petals 3; lower petal (keel) crested, connate to adjacent upper petals. Stamens 6-8, with filaments adnate to lower petal. Anthers single-loculed, opening by apical pore. Ovary 2-loculed; stigma 2-lobed with distal stigmatic surface tufted. Seed ellipsoidal to subspherical, short-pilose (glabrous only in *P. cymosa*); aril present, sometimes scarious or reduced to a minute scale, or absent.

Key to Taxa of Series *Decurrentes*

A. Inflorescence a cymose panicle of dense or elongated racemes, more or less flat-topped; lower leaves spatulate and withered or nearly so when plant flowers, or gramineous and persisting.
  B. Corolla and wings of calyx bright yellow; pedicels greater than 1.0 mm long.
    C. Basal leaves linear-lanceolate to linear, forming a large persistent rosette; stem more than 4 dm tall. 1. *Polygala cymosa.*
    C. Basal leaves broadly spatulate, usually withering once plant flowers; stem less than 4 dm tall. 2. *Polygala ramosa.*
  B. Corolla yellowish, wings of calyx white to greenish-white; pedicels less than 1.2 mm long. 3. *Polygala balduinii.*
    D. Inflorescence of dense racemes; wings definitely white; seed less than 0.6 mm long; aril on seed usually 0.2 mm long, infrequently smaller. 3a. var. *balduinii.*
    D. Inflorescence of more or less elongated racemes; wings cream to greenish-white; seed more than 0.6 mm long; aril on seed a minute scale or absent. 3b. var. *carteri.*
A. Inflorescence a solitary dense head-like raceme; lower leaves spatulate, persisting.
  E. Racemes bright yellow to orange; lobes of keel less than 1.5 mm long.
    F. Inflorescence yellow (drying yellow); lobes of keel bifurcated, 1 mm long. 4. *Polygala rugelii.*
    F. Inflorescence orange (drying yellow); lobes of keel single or occasionally bifurcated, less than 0.7 mm long. 5. *Polygala lutea.*
  E. Racemes lemon-yellow, greenish-yellow, to green; lobes of keel greater than 1.5 mm long.
    G. Inflorescence lemon-yellow to greenish-yellow; wings elliptic, involute

at apex; seed 1.6 mm long or less. 6. *Polygala nana.*

G. Inflorescence yellow-green to greenish; wings oblong-lanceolate, not involute at apex; seed 1.9-2.3 mm long. 7. *Polygala smallii.*

1. POLYGALA CYMOSA Walter, Fl. Car. 179. 1788.

TYPE: UNITED STATES: SOUTH CAROLINA: Berkeley County, T. Walter (HOLOTYPE: not seen and presumably no longer extant; the bulk of the Walter herbarium is lost, the small collection in the British Museum (Blake, 1915) appearing to be but a fragmentary representation given John Fraser (1789)). Fig. 1.

Polygala corymbosa Michx., Fl. Bor. Am. **2**:54. 1803.
Polygala graminifolia Poir. *in* Lam., Encycl. **5**:500. 1804.
Polygala attenuata Nutt., Gen. **2**:90. 1818.
Polygala acutifolia Torr. & Gray, Fl. N. Am. **1**:128. 1838.
Polygala cymosa Walt. var. *graminifolia* (Poir.) Torr. & Gray, Fl. N. Am. **1**:670. 1840.
Pilostaxis cymosa (Walt.) Small, Man. S. E. Fl. 744. 1933.

Biennial, erect, 45-110 cm tall, usually without branching below the inflorescence, from well-developed fibrous roots. Basal leaves 3.5-14 cm long, 0.2-0.6 cm broad, linear-lanceolate to linear, thin and flat, forming a large, persistent rosette; cauline leaves abruptly smaller, gradating in size to the bracts of the inflorescence. Inflorescence a single terminal cymose panicle, with numerous (to 150) racemose branches. Bracts 1-1.5 mm long, persistent. Pedicels 1-2 mm long. Flowers vivid yellow, turning from pale yellow to dark green upon drying. Upper sepaloid sepal 1.5-1.8 mm long, ovate, sparsely ciliolate; two lower sepaloid sepals 1.1-1.2 mm long, lance-ovate; petaloid sepals (wings) 2-4 mm long, 1.4-1.6 mm broad, oval to oval-oblong, 3-nerved, the apical portion involute. Petals 2.5-2.8 mm long, connate only at base; crest with 2-3 entire or bifurcating lobes. Seed 0.7-0.9 mm long, 0.6-0.7 mm broad, glabrous, rugose, with a small rostrum; aril minute, unlobed.

Anthesis: April through August.

Habitat and distribution: Moist to wet acid soil of open boggy communities and marshlands, often with the rosette beneath 1-10 cm water; peninsular Florida from Lake Okeechobee, northward on the Coastal Plain to southern Delaware and westward to Mississippi.

Polygala cymosa, with its gramineous leaves, glabrous seeds, and scarcely odorous roots, is clearly a peripheral member of the series *Decurrentes*. It cannot, however, be seen to have closer relationships elsewhere in the genus.

Representative specimens:

UNITED STATES: ALABAMA: Baldwin Co.: Wet boggy meadow in pinelands, 1 mi. n. of Stapleton, *Webster & Wilbur 3524* (NSC, US). Mobile Co.: Wet ground, Spring Hill, *Graves 1016* (MO, US). DELAWARE: Sussex Co.: Ditches and meadows, Ellendale, *Canby s. n.* (NY). FLORIDA: Duval Co.: Pine barren swamps, near Jacksonville, *Curtiss 511* (F, GA, MO, PH). Highlands Co.: In shallow water, border of Lake Lucas, n.e. of Sebring, *Garrett 143* (FLAS). Holmes Co.: Grassy pine flatwoods, 2.5 mi. s.w. of Bonifay, *Ford 3553* (FLAS). Martin Co.: Wet roadside ditch on Fla. 76, *Smith & Buchanan 124* (FLAS). Osceola Co.: Moist open pine area, 3.5 mi. e. of St. Cloud, *Smith & Buchanan 95* (FLAS). Santa Rosa Co.: In grassland, edge of cypress swamp, 7 mi. s. of Bagdad, *Ford 4128* (FLAS).

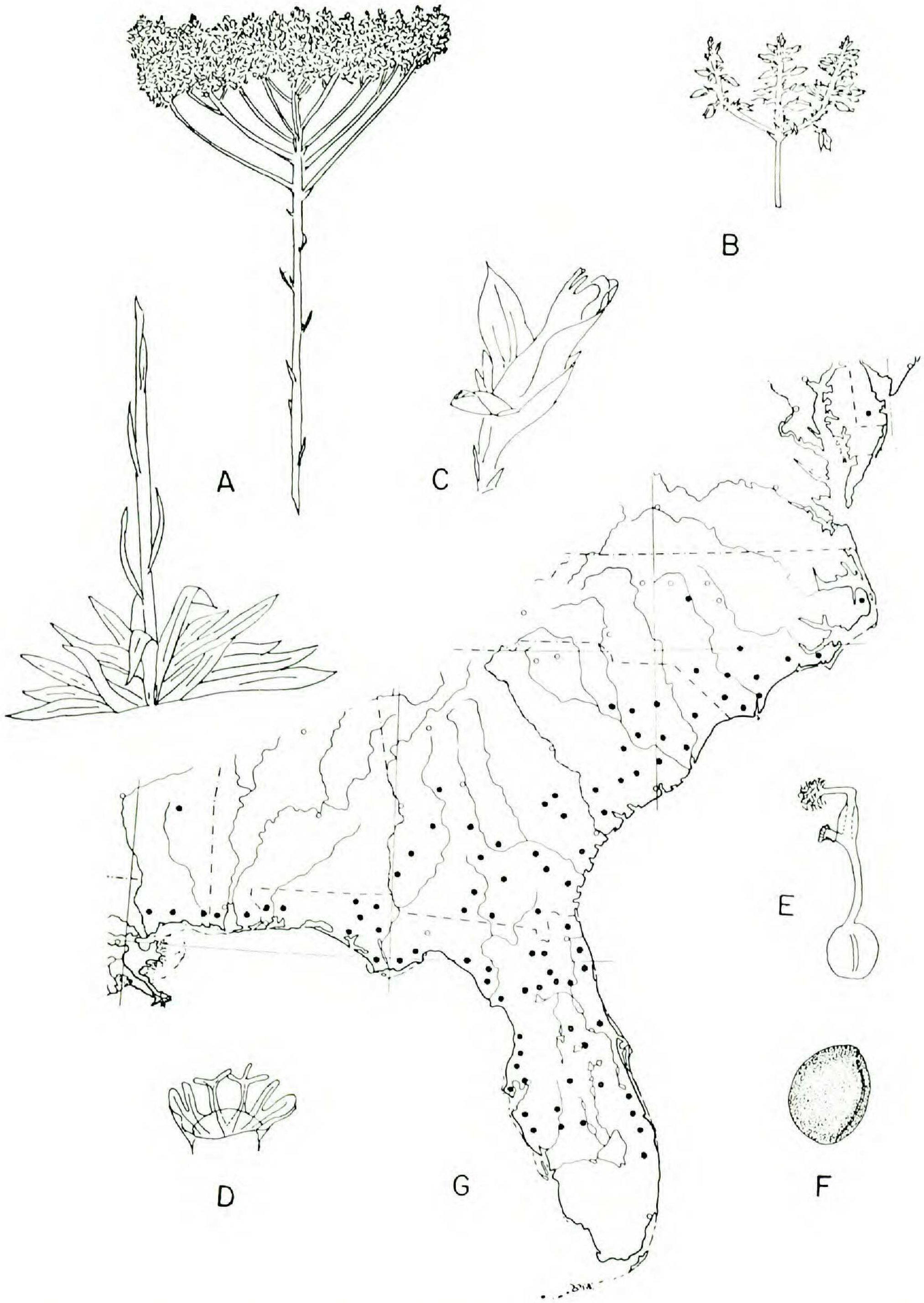


Figure 1. *Polygala cymosa*. A, habit × 1/5; B, 3 racemes at tip of peduncle × ⅔; C, single flower with one wing bent forward to expose petals × 8; D, crest on keel (lower petal) × 16; E, pistil × 10; F, seed × 15; G, distribution. (*Smith 70* [FLAS], Goldhead State Park, Fla.)

GEORGIA: Appling Co.: Dry bed of pool area in drainage way, 7.5 mi. e.s.e. of Baxley, *Duncan 11035* (GA, MO, NSC). Early Co.: Low undrained pinelands, 10 mi. s. of Blakely, *Hardin 141* (GA, NSC). Jenkins Co.: Wet sandy meadow, 0.5 mi. n.w. of Millen, *Pyron & McVaugh 929* (GA). McIntosh Co.: Low swampy soil near Darien, *Correll 5444* (DUKE, FSU, GA). Sumter Co.: Shallow pine-barren pond, w. of Leslie, *Harper 462* (F). MISSISSIPPI: Hancock Co.: Low pinelands, Necaise, *Sargent s. n.* (US). Jackson Co.: Ocean Springs, *Seymour 91-8-31* (F, FSU, MO, NCU). Newton Co.: *Tracy 5177* (MO). NORTH CAROLINA: Bladen Co.: In borrow pit, in standing water, 2.5 mi. e. of Elizabethtown, *Fox & Godfrey 2645* (NSC). Carteret Co.: In shallow acid pond, w. of Newport, *Whitford s. n.* (NSC). Dare Co.: Bog, 2 mi. s. of Manteo, *Radford 4639* (NCU). Wake Co.: Raleigh, *Hyams 682* (NSC). SOUTH CAROLINA: Berkeley Co.: Dried cypress pool, 5 mi. n. of Wanda, *Radford 5340* (NCU). Jasper Co.: Savannah, 2.1 mi. e. of Tillman, *Bell 3857* (FLAS). Marion Co.: Low pine savannah, s. of Britton Neck, *Bell 7871* (FSU, NCU). Sumter Co.: Cane savannah, *Stone 393* (NY, PH).

2. POLYGALA RAMOSA Elliott, Bot. S. Car. and Ga. 2:186. 1822.

TYPE: UNITED STATES: SOUTH CAROLINA: ? Charleston County, "ponds in the flat pine barrens," *S. Elliott* (HOLOTYPE: Stephen Elliott Herbarium, The Charleston Museum, Charleston, S. C., not seen; as photo NY!, US!). Fig. 2.

Polygala cymosa sensu Poir. *in* Lam., Encycl. 5:500. 1804; *non P. cymosa* Walt.

Polygala corymbosa Nutt., Gen. 2:89. 1818; *non P. corymbosa* Michx.

Polygala corymbosa sensu Torr. & Gray, Fl. N. Am. 1:128. 1838; *non P. corymbosa* Michx.

Polygala baldwinii var. *chlorogena* Torr. & Gray, Fl. N. Am. 1:129. 1838.

Pilostaxis ramosa (Ell.) Small, Man. S. E. Fl. 774. 1933.

Annual, erect, 10-38 cm tall, stems single or several, from fibrous roots. Basal leaves 3-7 cm long, 0.4-0.8 cm broad, spatulate, narrowing into petiole-like base, usually withering once plant flowers; cauline leaves spatulate-elliptic to linear. Inflorescence a cymose panicle, with few to many (to 110) racemose branches. Bracts 1.4-1.7 mm long, usually persistent. Pedicels 1.3-2.3 mm long. Flowers bright yellow, turning bright green or less frequently yellow-brown upon drying. Upper sepaloid sepal 1.2-1.6 mm long, wide lance-ovate; two lower sepaloid sepals 1.2-3 mm long, narrow lance-ovate; wings 2.5-3.5 mm long, 1.0-1.4 mm broad, obovate or elliptic-obovate, 3-nerved, involute at apex. Upper petals 2.5 mm long, ½ connate to lower petal (keel); keel 2.2 mm long; crest of simple or bifurcating lobes. Seed 0.6-0.7 mm long, 0.3-0.4 mm broad, with fine pubescence; aril minute to ¾ length of seed, 2-lobed.

Anthesis: April through October.

Habitat and distribution: Moist to wet, acid, moderately leached soil of low, open pine flatwoods and grassy roadside ditches; peninsular Florida, north on the Coastal Plain to Delaware, west to eastern Texas.

Polygala ramosa is closely related to *P. balduinii*. This similarity is obscured by the striking contrast between the yellow-flowered (green when dry) loosely branched inflorescence of *P. ramosa* and the white or near-white, more compact inflorescence of *P. balduinii*. Occasionally individuals occur that suggest hybridization; these have the flower color of *P. ramosa*,

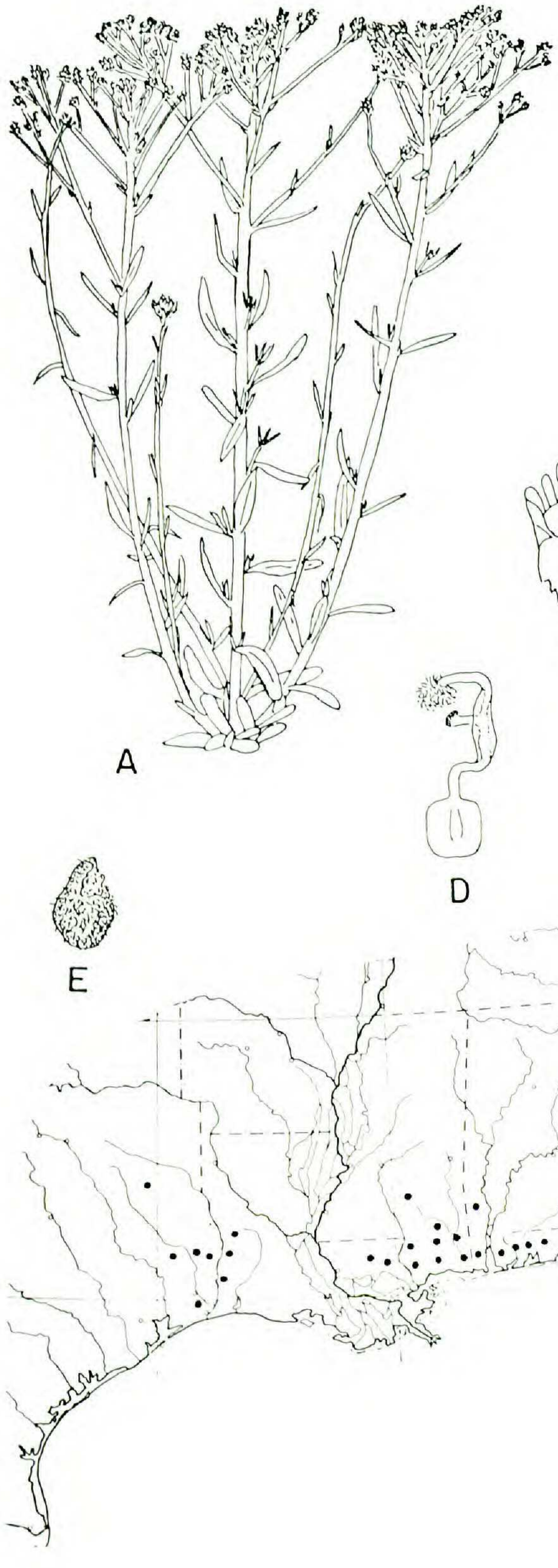


Figure 2. *Polygala ramosa*. A, habit × ⅓; B, single raceme × 5; C, crest on keel (lower petal) × 12; D, pistil × 8; E, seed × 15; F, distribution. (*Smith 94* [FLAS], Lake Butler, Fla.)

the compact inflorescences of *P. balduinii*, and pedicel lengths (1-2 mm) almost exactly intermediate. Such individuals have been called *P. balduinii* var. *chlorgena* Torr. & Gray (1838).

Representative specimens:

UNITED STATES: ALABAMA: Baldwin Co.: Low pine barrens, Magnolia Springs, *Schallert 758* (DUKE). Mobile Co.: In swamp, Spring Hill, *Bush 214* (MO, NY, US). Washington Co.: Low pineland, 4 mi. n. of Fruitdale, *Sargent s. n.* (GA, NSC). DELAWARE: Kent Co.: Felton, *Canby s. n.* (PH). Sussex Co.: Moist open sandy depression, e. of Ellendale, *Pennell 12869* (MO). FLORIDA: Alachua Co.: Low ground near Orange Heights, *Kea s. n.* (FLAS). Dade Co.: Low pineland back of Lemon City, *Small & Wilson s. n.* (F, NY). Escambia Co.: Dune area near Coast Guard station on Santa Rosa Island, *Ford 4484* (FLAS). Lee Co.: Moist sandy pineland, Pine Island, *Moldenke 942a* (NY). Osceola Co.: Shallowly flooded depression in cypress wooded area, Holopaw, *Howard 12965* (DUKE, FLAS, MO, NSC, NCU, NY, PH). Wakulla Co.: Sandy peat of ditch, 6 mi. n. of St. Marks Lighthouse, *Redfearn & Kral 2475* (DUKE, FSU, NY). GEORGIA: Baker Co.: Low open grassy meadow, 11 mi. n. of Newton, *Thorne 5032* (F, MO, NY). Charlton Co.: St. Mary's River swamp, below Trader's Hill, *Small s. n.* (F, NY). Chatham Co.: Pine barren near Half Moon Lake, *Eyles 6236* (GA). Laurens Co.: Moist sandy woodland, 10 mi. e. of Dublin, *Pyron & McVaugh 748* (GA). Richmond Co.: Pineland bog, Augusta, *Cuthbert s. n.* (NY). LOUISIANA: Calcasieu Parish: Vicinity of Lake Charles, *Allison 77* (US). St. Tammany Parish: Open pineland, 1 mi. n. of Abita Springs, *Pennell 4148* (NY, PH). Vernon Parish: Fairly wet grassy area, 2 mi. w. of Leander, *Webster & Wilbur 3242* (NSC, US). MISSISSIPPI: Covington Co.: Open pineland, 1.5 mi. s.e. of Mt. Olive, *Webster 3334* (NSC, US). George Co.: Abundant on black peat-loam of hillside bog, 1 mi. n.w. of Alabama line, *Kral 1298* (FSU). Pearl River Co.: Low pinelands, Picayune, *Sargent s. n.* (US). NORTH CAROLINA: Columbus Co.: Moist ditches and along seepage areas in large open savannah, 1.5 mi. n.e. of Nakina, *Wilbur 4204* (FSU, GA, NSC). Dare Co.: Along margin of swamp, n. of Wanchese, *Beal 1101* (NSC). Jones Co.: In savannah, 20 mi. s. of Kinston, *Wilbur 4093* (FSU, GA, NSC). Rowan Co.: Salisbury, *Porter & Heller s. n.* (NSC). SOUTH CAROLINA: Clarendon Co.: Grass-sedge bog or savannah, 3 mi. s.e. of Manning, *Godfrey & Tryon 912* (NY, US). Hampton Co.: Pine savannah, 3.1 mi. n.w. of Yemassee, *Ahles & Bell 15747* (NCU). Horry Co.: Open savannah near Myrtle Beach, *Correll 5277* (DUKE). Lexington Co.: Boggy swale, 5 mi. s. of Columbia, *Godfrey & Tryon 1265* (NY, US). TEXAS: Houston Co.: Sandy open bogs, Grapeland, *Palmer 12850* (MO, NY, US). Jasper Co.: Jasper, *Fisher 32123* (F). Jefferson Co.: Beaumont, *Hooks s. n.* (MO). VIRGINIA: Sussex Co.: Dry argillaceous field, n. of Littleton, *Fernald & Long 6263* (MO, US).

3. POLYGALA BALDUINII Nuttall, Gen. 2:90. 1818.

TYPE: UNITED STATES: FLORIDA: Nassau County, *W. Baldwin* (HOLOTYPE: Thomas Nuttall Herbarium, Academy of Natural Sciences, Philadelphia, not seen). Fig. 3.

Annual or biennial, stems 10-65 cm tall, rarely branched below inflorescence, single to several from thick fibrous or indefinite tap-root base. Basal leaves 0.5-2.5 cm long, 0.3-1.2 cm broad, obovate to spatulate, obtuse or rounded, crowded into irregular rosette, withered or nearly so when plant flowers; cauline leaves graduating from broad-eliptic to linear. Inflorescence a cymose panicle of numerous (to 40) racemose branches. Bracts 1.5-2.2 mm long, persistent. Pedicels 0.6-1.2 mm long. Flowers white or cream to greenish-white, drying from white to brownish-green. Upper sepaloid sepal 1.8-2.4 mm long, lance-ovate; two lower sepaloid sepals 1.6-2.2 mm long, lanceolate or linear-lanceolate; wings 2.8-4.8 mm long, 0.9-1.7 mm broad, 3-nerved, narrowing into a cusp-like apex. Petals 1.7-2.8 mm long, yellowish, connate at base only; crest with large simple lobes at lateral edges and

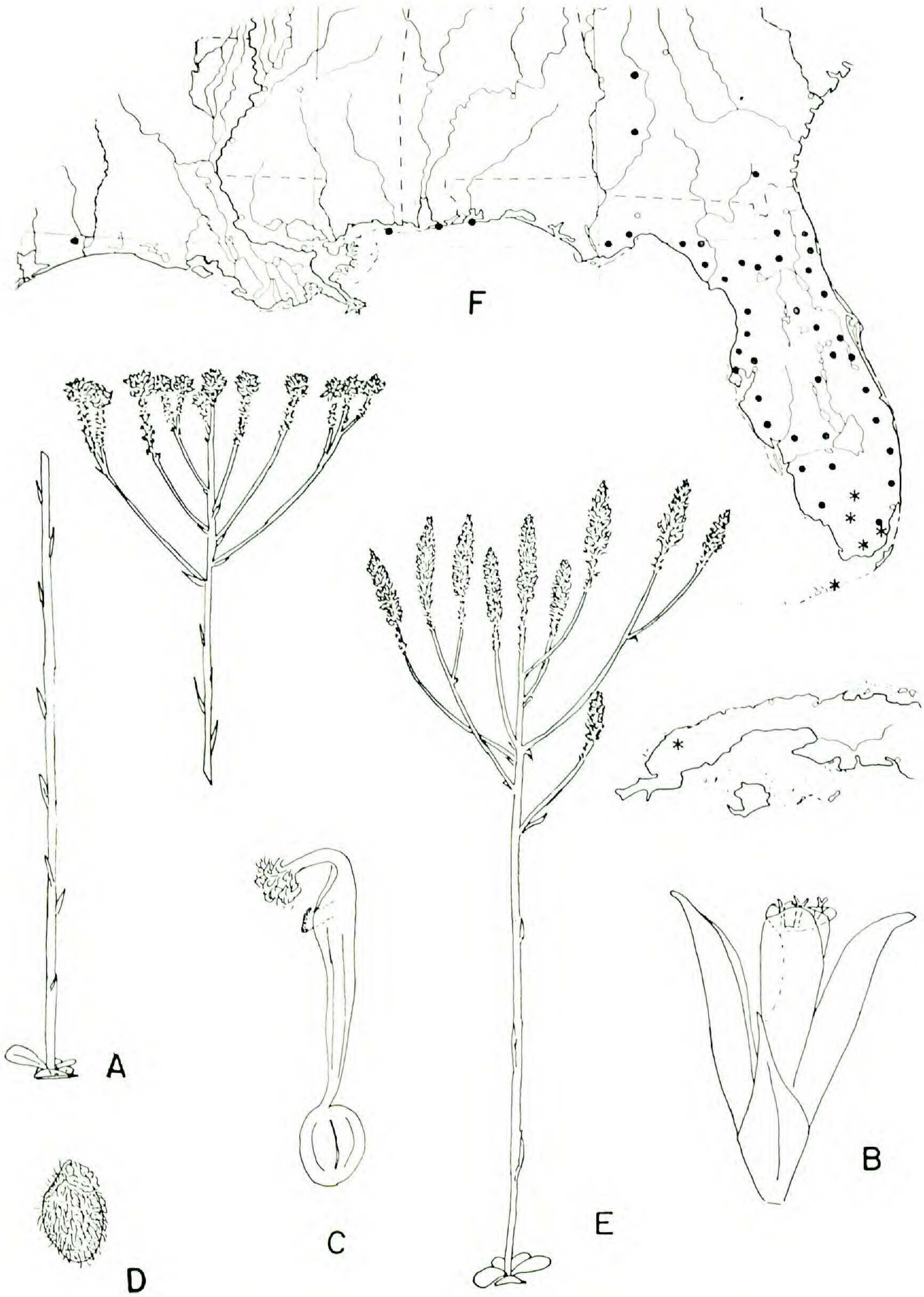


Figure 3. *Polygala balduinii*. A—D, var. *balduinii*: A, habit × ⅓; B, flower (adaxial view) showing crest on lower petal × 8; C, pistil × 10; D, seed × 15 (*Smith 122* [FLAS], Martin Co., Fla.). E, var. *carteri*: habit × ⅓ (*Smith 103* [FLAS], Everglades Nat. Park, Fla.). F, distribution: var. *balduinii* (dots), var. *carteri* (asters—S. Fla. and Cuba).

simple or bifurcating lobes in center. Seed 0.5-0.7 mm long, 0.4-0.5 mm broad, moderately pilose, with a small rostrum; aril scarious, of 2 appressed oval lobes, to 0.2 mm long, or a minute scale.

When Nuttall first proposed this name he Latinized the epithet as "*Balduini*"; this was purposeful as indicated by its repetition in his discussion. Torrey & Gray (1838) improperly modified the spelling to "*Baldwinii*" and have largely been followed by later authors. Article 73 of the International Code, however, compels the use of "*balduinii,*" reflecting corrections both in typography and orthography.

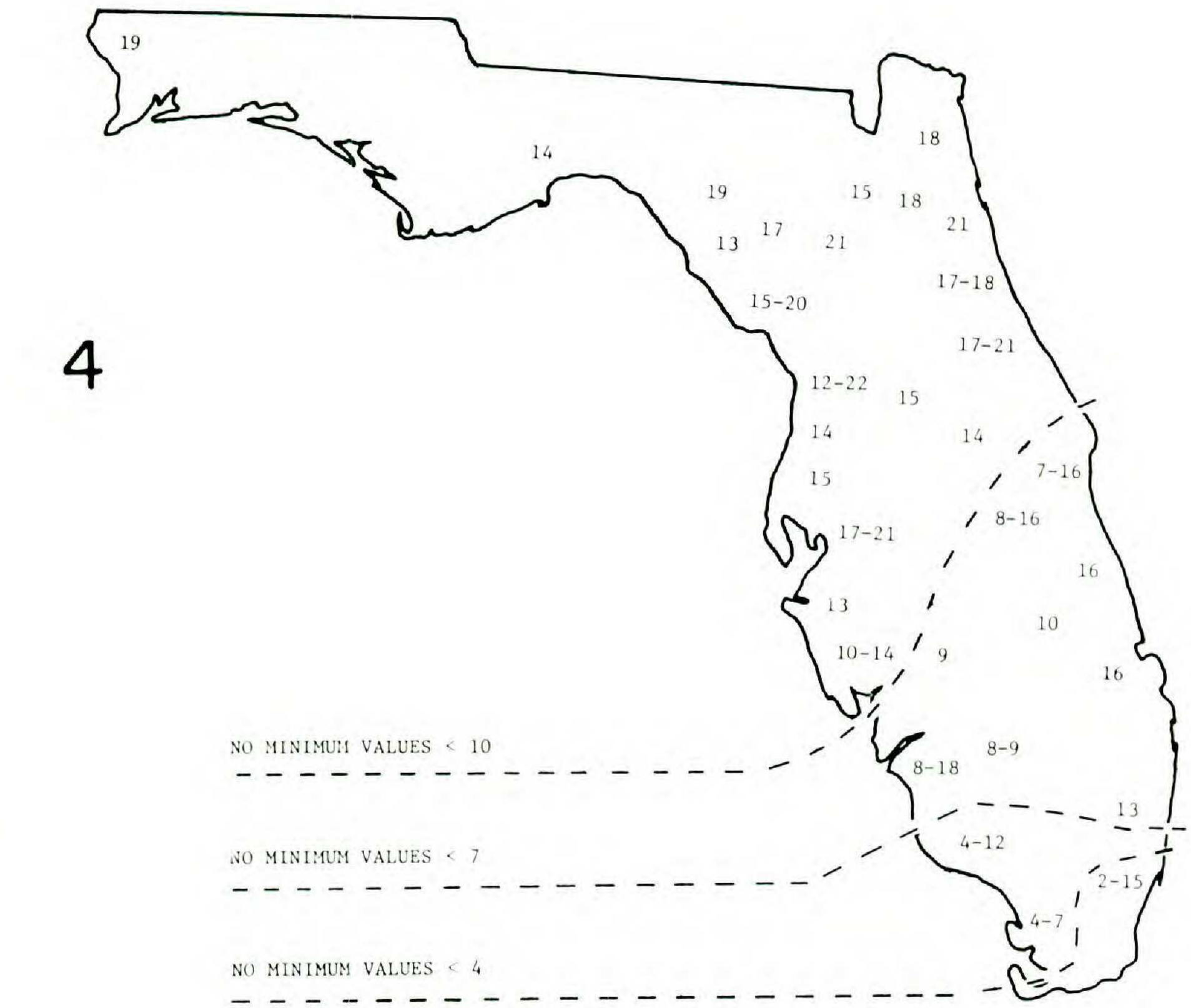
Small (1905) described from South Florida a new species of *Polygala* which he considered related to *P. balduinii.* He named it *P. carteri* in honor of his fellow collector, J. J. Carter. He first distinguished it from *P. balduinii* by the presence of elongate racemes and cuspidate wings, and later (1933) by an additional series of partially overlapping characters including flower color, size of capsule, and length of seed. A few of Small's criteria at first reading appear quite distinct, but they are not so apparent when applied to specimens from southern Florida. Blake (1924) recognized *P. carteri* without equivocation, but Miller (1971) thought it 'possibly conspecific" with *P. balduinii*, and Long & Lakela (1971) without comment reduced it to synonymy under that name.

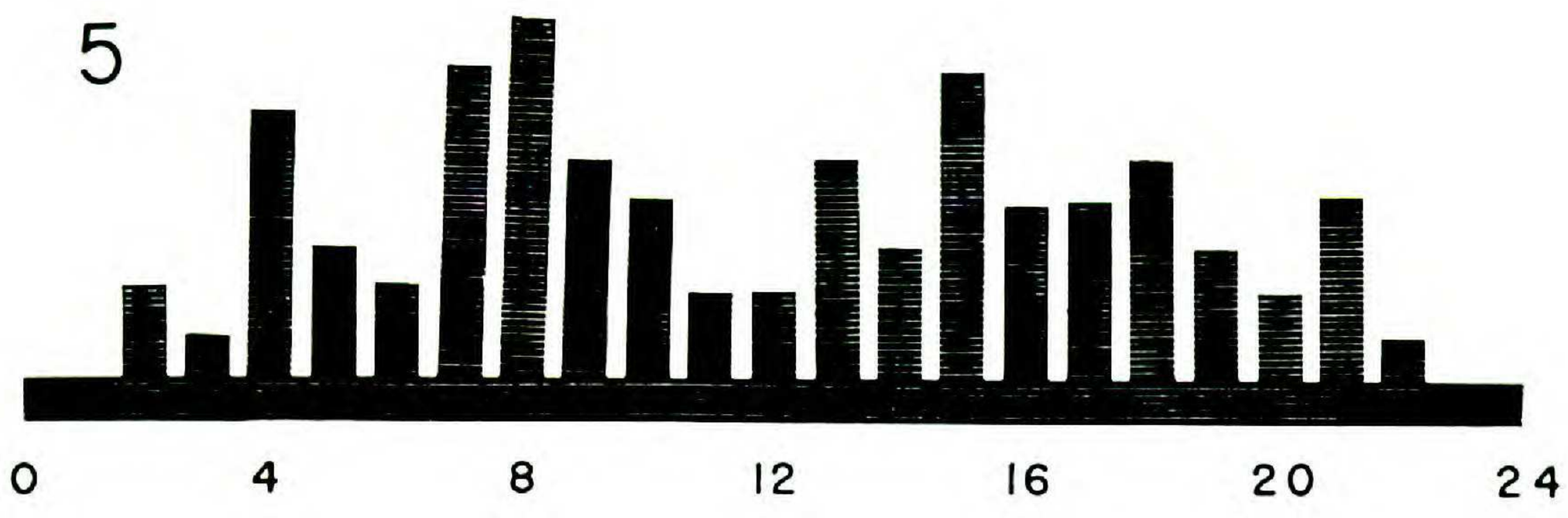
Even cursory examination of *Polygala* in the field in South Florida reveals that in that area plants of *P. balduinii* s. l. are more variable than elsewhere in the range of the species. The flower color varies from white to cream to greenish-white; the racemose branches of the cymose panicle vary markedly in their degree of elongation; and a number of less conspicuous floral characters extend beyond the range of variability observed northward. Yet, as implied by the criteria cited by Small and by Blake, many individuals are not clearly assignable to either of the two species.

Wing size appears to be among the more discriminating characters. The wings of the South Florida plants are more uniform in size (3-4 mm long, 1.5-1.7 mm broad) with a short apical cusp (0.3-0.5 mm long), while *P. balduinii* elsewhere in its range is more varied (2.8-4.8 mm long, 0.9-1.4 mm broad) with a longer cusp (0.6-0.8 mm long).

Seed size definitely overlaps, but *P. "carteri"* tends to have larger seeds, approaching 1 mm in length. The aril, which is characteristically present on the seed elsewhere in the range of *P. balduinii,* is often absent in southern Florida.

A degree of additional objectiveness was provided by the use of a hybrid index, as popularized by Anderson (1949), for six characters: length of bract, wing width, length of upper sepal, length of cusp-like attenuation, length of seed, and presence or absence of aril. Equal weight was given each character (scaled from 0 to 4), with lowest values assigned to *P. "carteri"* and the highest to *P. balduinii* s. s. Data were obtained from 80 plants from 33 Florida counties. These have been plotted on a map of





Figures 4-5. Objective representation of variation within 80 plants of *Polygala balduinii* from 33 Florida counties, involving six characters. Fig. 4, a map of Florida showing low and high histogram values (low values = var. *carteri*, high values = var. *balduinii*); dashed lines indicate northern limits of low histogram values, restricting var. *carteri* morphotypes to southern end of the state, with var. *balduinii* occurring throughout. Figure 5, histogram, the abscissa being the possible totals obtainable by summation of values for the six measured characters, the ordinate being the number of individuals.

Florida (Fig. 4) and charted on a standard histogram (Fig. 5).

Measurements of the six utilized characters, when converted to histogram values and plotted on a map, show a striking restriction of plants with low values (characteristic of *P. "carteri"*) to the southern counties of Florida, with a perceptible increase in these minimum values as one moves northward in the state. Only within Dade County, the type locality for *P. carteri*, do values of 2 occur (with 0 the theoretical extreme for "pure" *P. "carteri"*). Adjacent Collier and Monroe counties have plants with values as low as 4, while it is necessary to travel almost to the center of the peninsula to obtain values in excess of 9. In contrast, plants with high histogram values (24 being the theoretical extreme for *P. balduinii* s. s.) occur throughout the state, and presumably throughout the southeastern Coastal Plain, reflecting the widespread distribution of individuals typical of the species.

The histogram (Fig. 5) incorporates values for all individuals measured. Its lack of bimodality supports observations in the field, that many individuals are intermediate in morphology. The definite regional tendency for South Florida plants to vary beyond the norms for the species does not seem sufficient for specific recognition. It is here proposed to give recognition to the differing individuals in South Florida only at the varietal level.

3a. POLYGALA BALDUINII var. BALDUINII

Polygala polycephala Balddw. ex Nutt., Gen. 2:90. 1818; as manuscript name.
Polygala "Baldwinii" sensu Torr. & Gray, Fl. N. Am. 1:128. 1838.
Pilostaxis "Baldwinii" (Nutt.) Small, Man. S. E. Fl. 774. 1933.

Racemes generally short and dense, to 3 cm long, 0.6-1 cm thick; bracts usually over 2 mm long. Flowers white, drying white to brownish. Upper sepaloid sepal usually over 2 mm long; wings 2.8-4.8 mm long, 0.9-1.4 mm broad, narrowing into lengthened cusp-like apex 0.6-0.8 mm long. Seed usually less than 0.6 mm long; aril 0.2 mm long, occasionally much smaller.

Anthesis: January through November.

Habitat and distribution: Moist to wet open pine flatwoods and moist grassy roadsides, often intermittently flooded; frequently sympatric with *P. ramosa*; peninsular Florida, northward to central Georgia and west (locally) to southern Mississippi and eastern Texas.

In gross appearance, *Polygala balduinii* var. *balduinii* is generally more robust than var. *carteri*, having taller stems and a larger and more conspicuous inflorescence. Specimens from a population in Lee County, Florida, were noted to have seeds lacking the characteristic pilose pubescence [*W. E. Liggett 1979a*, s.e. of Ft. Myers (FLAS)].

Representative specimens:

UNITED STATES: FLORIDA: Alachua Co.: In slash-longleaf pine flatwoods, between Gainesville and Newnan's Lake, *Ward 1281* (FLAS). Broward Co.: Low pinelands, Ft. Lauderdale, *Small & Wilson 1629* (NY). Collier Co.: Very moist grass-palmetto area, along U.S. 41, *Smith 372* (FLAS). Dade Co.: Humbugus Prairie, *Small, Mosier & Small*

6880 (NY, US). Duval Co.: Moist pine barrens, near Jacksonville, *Curtiss 504* (F, MO, NY, PH). Escambia Co.: Dune area near Coast Guard station on Santa Rosa Island, *Ford 4483* (FLAS). Franklin Co.: Low pine barrens, Apalachicola, *Saurman s. n.* (MO, NY, PH). Indian River Co.: Pinelands near Fellsmere, *Small 8883* (NY). Lake Co.: Swamp, vicinity of Eustis, *Nash 1179* (F, MO, NY, PH, US). Levy Co.: Peaty roadside ditch, 4 mi. e. of Cedar Key, *Kral 6989* (NCU, NY). Polk Co.: Open grass-sedge meadow, 9 mi. s.w. of Kissimmee, *Wilbur & Webster 2638* (NSC). Volusia Co.: Low flatwoods, Lake Helen, *Hood s. n.* (MO). GEORGIA: Baker Co.: Low open grassy meadow, 11 mi. n. of Newton, *Thorne 5049* (F, MO, NY, US). Charlton Co.: St. Mary's River swamp, below Trader's Hill, *Small s. n.* (F, NY, US). Sumter Co.: Moist shady pine-barrens, 2 mi. s.w. of Leslie, *Harper 1405* (F, MO, NY, US). MISSISSIPPI: Jackson Co.: Horn Island, Bay of Biloxi, *Tracy 1356* (F, MO, Y). TEXAS: Jefferson Co.: *Smith s. n.* (PH).

3b. POLYGALA BALDUINII var. **carteri** (Small) Smith & Ward, stat. nov.

Polygala carteri Small, N.Y. Bot. Gard. Bull. 3:426. 1905.
TYPE: UNITED STATES: FLORIDA: Dade County, "pinelands between Cutler and Black Point," *J. K. Small & J. J. Carter 813* (HOLOTYPE: NY!).
Pilostaxis carteri (Small) Small, Man. S. E. Fl. 774. 1933.

Racemes elongated and usually loose, 0.4-6 cm long, 0.4-1.3 cm thick; bracts usually less than 2 mm long. Flowers greenish-white to greenish-cream, drying as such with brownish tinge. Upper sepaloid sepal usually less than 2 mm long; wings 3-4 mm long, 1.5-1.7 mm broad, with apex short-tipped, 0.3-0.5 mm long. Seed usually 0.6-0.7 mm long; aril a minute scale, or absent.

Anthesis: March through August; December.

Habitat and distribution: Wet to seasonally very dry marl prairies, occasionally on calcareous waste areas or moist grassy roadsides; endemic to South Florida (Collier, Dade, and Monroe counties, including the Florida Keys), locally in western Cuba.

Polygala balduinii var. *carteri* is a less striking plant than var. *balduinii;* the plants are on average smaller, and the inflorescences are much more green and less conspicuous. Its northern limit is set more as a matter of arbitrary convenience than of objective judgment, for individuals with partial manifestation of the characteristics of the more extreme South Florida populations may be found, particularly in coastal areas (Brevard County), appreciably further north (Fig. 4).

Representative specimens:

CUBA: Pinar del Rio: In wet places, Remates, Cienaga La Tumba, *Ekman 11301* (US). UNITED STATES: FLORIDA: Collier Co.: In grassy glades, Copeland, *Brass 15403* (US); Deep Lake, *Scull s. n.* (FLAS). Dade Co.: Cut-over pineland, 6 mi. w. of Royal Palm Park, *Deam 60930* (DUKE); In tropical pineland on limestone, 5 mi. w. of Royal Palm Hammock, *O'Neill 7591* (F); Low pinelands, s. of Cutler, *Small & Carter 3065* (NY); Everglades near Cocoanut Grove, *Small & Wilson s. n.* (DUKE, FLAS); Glade, Key Biscayne, *Tatnall 842* (PH). Monroe Co.: Prairie at abandoned lumber camp, Pinecrest, *Arnold s. n.* (FLAS); Margin of pond along road to Watson Hammock, Big Pine Key, *Killip 44984* (FLAS).

4. POLYGALA RUGELII Shuttleworth ex Chapman. Bot. Gaz. 3:4. 1878.
TYPE: UNITED STATES: FLORIDA: Hillsborough County, "Tampa," *F. Rugel* s. n. (HOLOTYPE: not seen, presumably among the Alvan Wentworth Chapman collections of the Gray Herbarium; Rugel in 1845

collected near Tampa Bay, sending his materials to Robert Shuttleworth in Berne, Switzerland, who marketed large numbers of them to institutions and individuals in North America). Fig. 6.
Polygala reynoldsiae Chapm., Fl. S. U. S. 613. 1883.
Pilostaxis rugelii (Shuttlew. ex Chapm.) Small, Man. S. E. Fl. 774. 1933.

Annual or biennial, erect or ascending, 20-78 cm tall, with long branches from main axis, arising from definite tap-root. Basal leaves 3-6 cm long, 0.5-1.5 cm broad, spatulate, obtuse to rounded, succulent, drying rugose; cauline leaves gradating from oblanceolate to lanceolate. Inflorescence a head-like raceme, ovoid to thick cylindric, usually 2.5-3 cm long, 1.8-2.5 cm thick, occasionally elongated. Bracts 3.5-5 mm long, usually deciduous. Pedicels 2-2.5 mm long. Flowers bright yellow, drying pale yellow to dark greenish-brown. Sepaloid sepals 1.5 mm long, the upper deltoid-subulate, cuspidate; wings 4.5-8 mm long, 2-4 mm broad, oblong to oblong-elliptic, 7-nerved, the apex short-acuminate to apiculate. Petals 5.2-5.5 mm long; crest with bifurcating lobes 1 mm long. Seed 1.2-1.6 mm long, moderately pubescent; rostrum 0.2 mm long, rounded; aril membranous, to length of seed or longer.

Anthesis: April through November.

Habitat and distribution: Low moist open pinelands and well-drained palmetto-pine associations; endemic to peninsular Florida.

Polygala rugelii, although less common than *P. lutea* with which it is often found, when in flower is a conspicuous member of the Florida flora. Occasional populations [cf. *M. C. Reynolds s. n.*, St. Johns Co. (NY)] exhibit an elongation of the raceme. This anomaly was observed by Chapman (1883) who introduced the name *P. reynoldsiae* (in honor of the collector, Mary Reynolds, St. Augustine, Florida) for what he thought to be a new species. Such an elongation has also been observed in *P. lutea*.

Representative specimens:

UNITED STATES: FLORIDA: Alachua Co.: Openings in Serenoa repens—Lyonia lucida brush, 2.6 mi. w. of Island Grove, *Ward 1940* (FLAS, FSU). Brevard Co.: Flatwoods, w. of Sharpes, *Rhoads s. n.* (FLAS). Collier Co.: Open pine stand, 0.3 mi. s. of North Naples city limit, *Ward 1805* (FLAS). Dade Co.: Low pinelands, back of Lemon City, *Small & Wilson 1967* (NY). Flagler Co.: Low pinelands near Bunnell, *Wise s. n.* (FLAS). Hardee Co.: Pasture, e. of Zolfo Springs, *Cooley, Wood & Wilson 6092* (FSU, NY). Hernando Co.: Flatwoods pond margin, Weeki Wachee Springs, *Kral 7003* (FLAS, FSU, NY, US). Indian River Co.: Dry sandy area on Fellsmere road, *Smith & Myint 704* (FLAS). Lafayette Co.: Flatwoods, 3 mi. s. of Mayo, *West & Arnold s. n.* (FLAS). Lake Co.: Wet soil of ditch, near road to Astor Park, *Adams 606* (FSU). Lee Co.: Pineland, vicinity of Ft. Myers, *Standley 177* (NY, US). Levy Co.: Pine flatwoods, 1 mi. w. of Bronson, *Godfrey & Lindsey 56995* (FSU). Martin Co.: Bank of wet ditch, 0.4 mi. s. of St. Lucie Co. line, *Smith & Buchanan 126* (FLAS). Orange Co.: Open pine-palmetto area, 3.4 mi. n.w. of Brevard Co. line, *Smith & Buchanan 141* (FLAS). Pasco Co.: Sandy palmetto flatwoods, w. of Zephyrhills, *Hood 3501* (FLAS). Pinellas Co.: Moist open pine-palmetto area, St. Petersburg, *Smith 160* (FLAS). St. Lucie Co.: Open grassy field, 6.3 mi. s. of White City, *Hansen 928* (FLAS). Sarasota Co.: Sandy peat of depression in pine-saw palmetto flats, 3 mi. s. of Venice, *Kral 7481* (FLAS, NCU).

5. POLYGALA LUTEA Linnaeus, Sp. Pl. 705. 1753.

TYPE: UNITED STATES: NEW JERSEY: ? Gloucester County, *P. Kalm s.n.* (HOLOTYPE: 882.39 [Savage, 1945], Linnaean Herbarium, London, not seen; as microfiche!). Fig. 7.

Polygala lutea L. var. *elatior* Michx., Fl. Bor. Am. 2:54. 1803.

Polygala lutea L. var. *pauciflora* Raf., New Fl. N. Am. 4:90. 1838.

Polygala pseudosenega Bertol., Mem. Accad. Bologna 5:400. 1854: with exception of phrase, "Flores rosei."

Pilostaxis lutea (L.) Small, Man. S. E. Fl. 744. 1933.

Biennial or perennial, ascending and spreading or erect, 6-42 cm tall, with variations from a solitary unbranched axis to many stems branched or unbranched from a thick base; tap-root well developed in larger specimens, more fibrous in smaller plants. Basal leaves 1.5-5.8 cm long, 0.7-2 cm broad, spatulate to obovate, succulent with obscure venation, drying rugose, in an irregular rosette; cauline leaves obvate to oblanceolate. Inflorescence a head-like cylindric raceme, 8-33 mm long, 8-20 mm wide, rarely elongated (to 4 cm long). Bracts 2.5-3 mm long, deciduous. Pedicels 1.5-2.7 mm long. Flowers vivid orange to yellow-orange, usually turning a dull, pale yellow on drying. Sepaloid sepals 1.2-1.4 mm long, the upper ovate-acuminate, minutely ciliolate; wings 5.0-7.0 mm long, 2.7-3.6 mm broad, slightly oblique-elliptic, acuminate to short pointed, 5- to 6-nerved, partially involute at apex and slightly narrowed at base, minutely ciliolate. Petals 3.5-4.2 mm long, 2/3 connate; crest 0.5-0.7 mm long, of single or slightly bifurcated lobes. Seed 1.4-1.6 mm long, pilose; rostrum 0.3 mm long.

Anthesis: February through November.

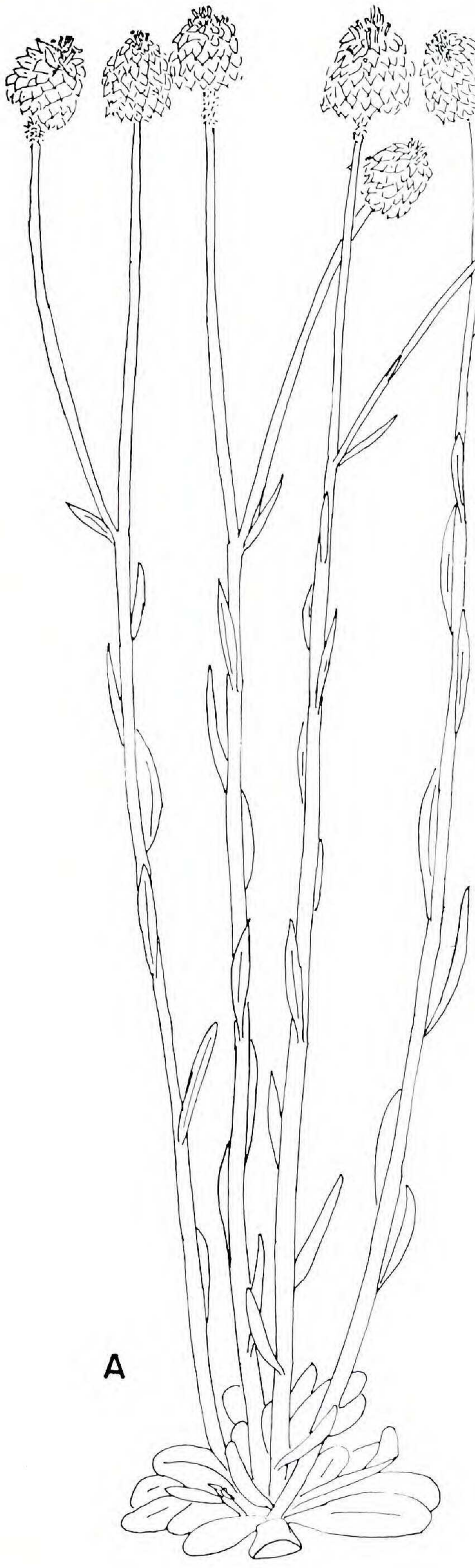
Habitat and distribution: Typically acid soil with high water table, common in pine flatwoods, open grassy areas, or pine barrens; peninsular Florida north of Ft. Meyers, northward on the Coastal Plain to New Jersey and Long Island, New York, westward to eastern Louisiana.

Polygala lutea is both the most widespread and the most abundant member of the series *Decurrentes*. Although the epithet was doubtless suggested by the color of the dried flowers, the living plants with their conspicuous orange inflorescences are a characteristic component of the acid flatwoods Coastal Plain flora. Hardin (1961) reported a color variation of lemon yellow for a single plant from Brunswick County, North Carolina.

This species is closely related to *P. nana*, *P. smallii*, and *P. rugelii*, and specimens are frequently encountered bearing one of these names. It is most definitely separated by the very small, largely non-bifurcating lobes of the crest, the otherwise distinctive orange flowers fading with maturity or with drying. Intermediates have not been encountered with *P. nana* or *P. smallii*. A single possible hybrid with *P. rugelii* revealed over 65% of the pollen grains as apparently non-functional.

Representative specimens:

Figure 6. *Polygala rugelii*. A, habit × ⅓; B, flower × 3; C, crest on keel (lower petal) × 12; D, pistil × 8; E, seed × 15; F, distribution, (*Smith 83* [FLAS], Trenton, Fla.)



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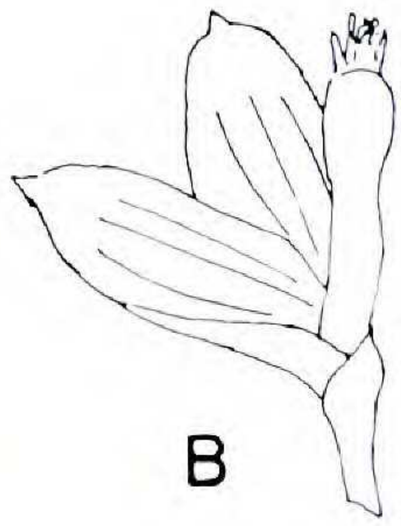

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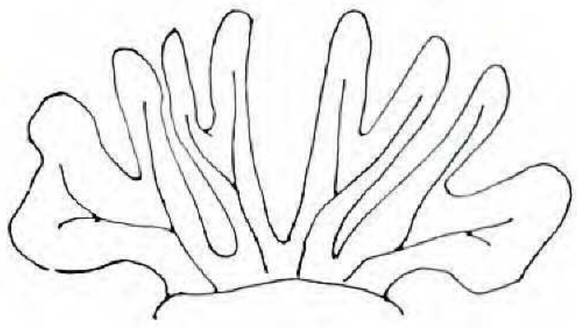

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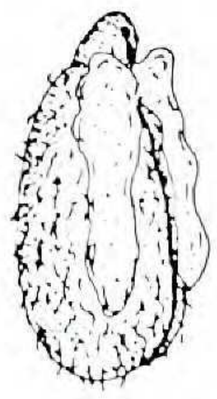

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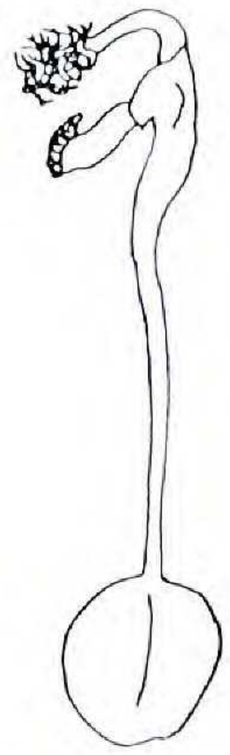

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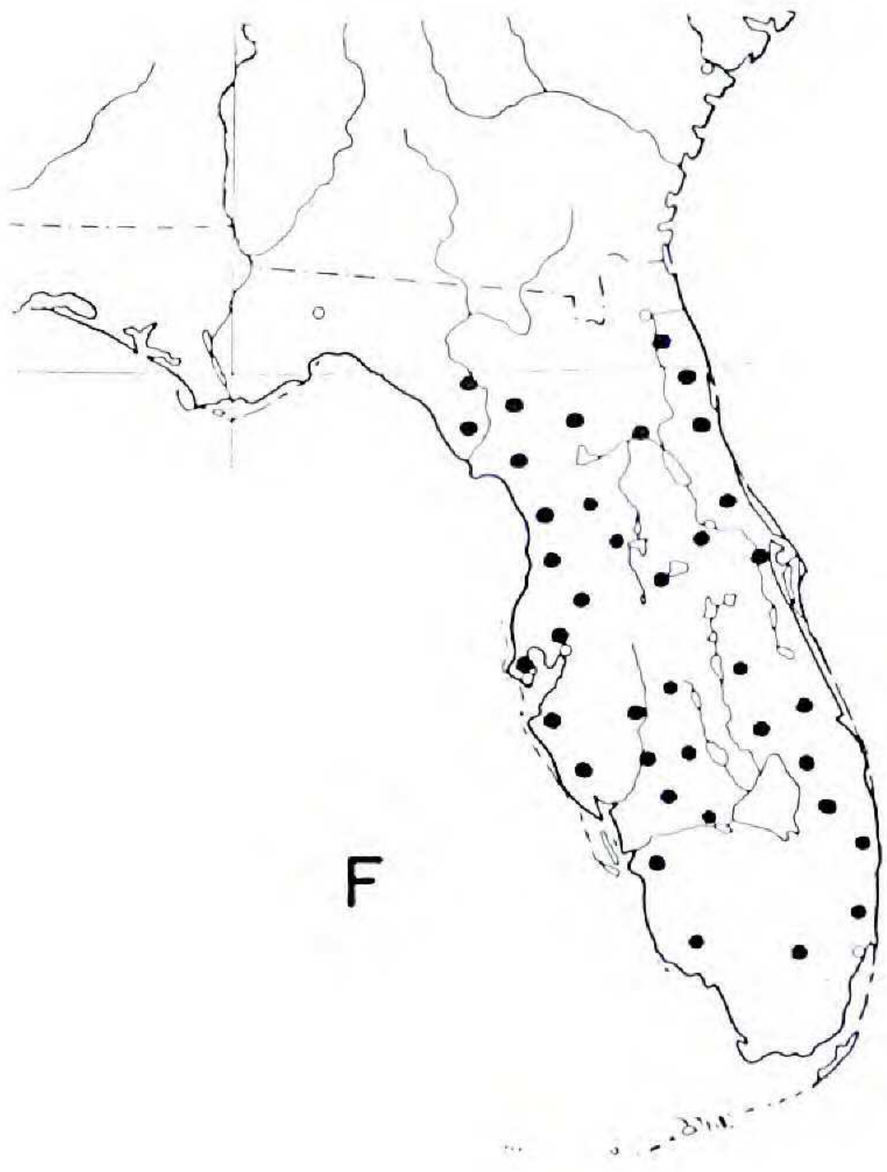

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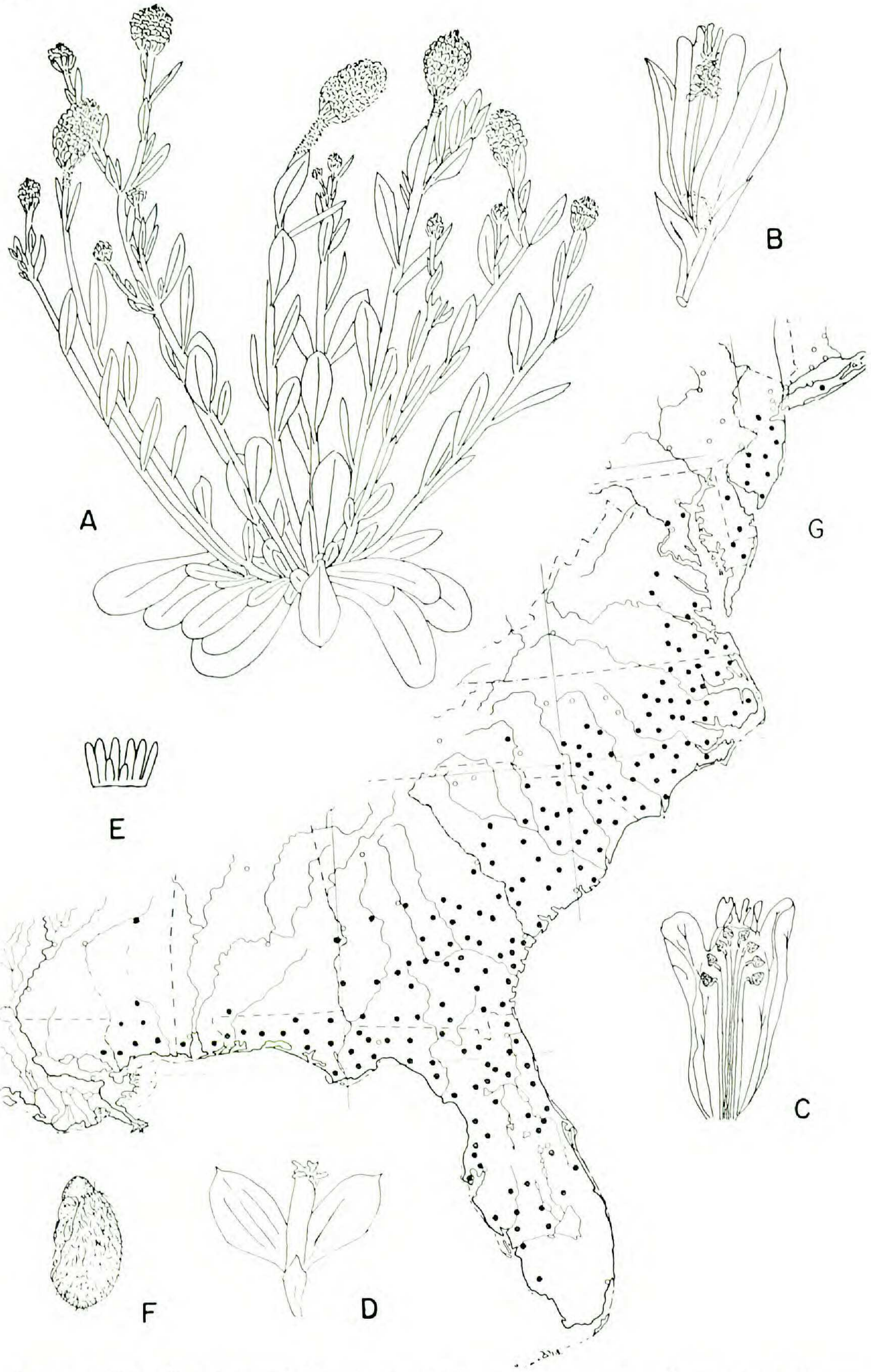


Figure 7. *Polygala lutea*. A, habit × ⅓; B, flower with upper petals separated, showing androecium and style, with hidden ovary indicated by shadowing × 4; C, corolla with upper petals widely separated showing androecium adnate to keel (lower petal) × 5; D, flower, with prominent petaloid sepals and inrolled 3-petaled corolla × 3; E, crest on keel × 12; F, seed × 15; G, distribution. (Drawn from fresh material, Alachua Co., Fla.)

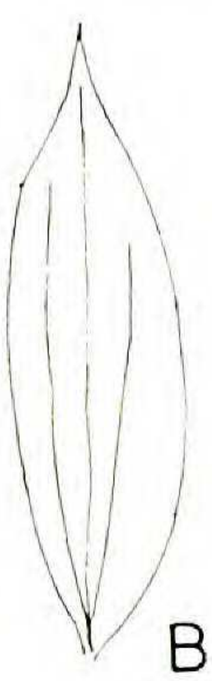
UNITED STATES: ALABAMA: Baldwin Co.: Pine barrens, 5 mi. n. of Bay Minette, *LeClair s. n.* (NCU). Escambia Co.: Moist ground near spring, Escambia Exp. Forest, *Gaines 235* (NY). Mobile Co.: In swamps, Spring Hill, *Bush 221* (MO, NY). Russell Co.: Moist area on steep slopes on side of high ridge, 2 mi. w. of Phenix City, *Duncan 9641* (GA). DELAWARE: Kent Co.: In swamps near Harrington, *Gleason s. n.* (DUKE). Sussex Co.: Wet thick near Georgetown, *Britton 58* (NY). FLORIDA: Collier Co.: Sand flat near Immokalee, *Scull s. n.* (FLAS). Columbia Co.: Along roadside, 6.6 mi. s.e. of Suwannee River, *Smith & Myint 287* (FLAS). Flagler Co.: Flatwoods n. of Andalusia, *West & Arnold s. n.* (FLAS). Liberty Co.: Shallow pond in pineland, Bristol, *West & Arnold s. n.* (FLAS). Okeechobee Co.: Bayhead in longleaf pine, n. of Ft. Drum, *West s. n.* (FLAS). Putnam Co.: Low ground, Johnson, *Barnhart 2134* (NY). Santa Rosa Co.: Grassy pine flatwoods, 2 mi. s.e. of Milton, *Ford 4073* (FLAS). Union Co.: Flatwoods, 2 mi. s.w. of Raiford, *Murrill s. n.* (FLAS). GEORGIA: Brooks Co.: Moist savannah, 0.5 mi. n.e. of Barney, *Wilbur 3423* (GA, NSC). Bryan Co.: Sandy humus in thin pine woods, 7.8 mi. s.e. of Richmond Hill, *Moore & Lawrence 748* (FLAS, GA). Decatur Co.: Wet sandy soil, headwaters swamp of Willacoochee Creek, near Faceville, *Thorne, Muenscher & Smith 3023* (GA). Laurens Co.: Pine woods, s.w. of Cadwell, *Duncan 5000* (GA). Richmond Co.: Sandy low barrens, Augusta, *Cuthbert s. n.* (NY). LOUISIANA: St. Tammany Parish: Open pine woods, 5 mi. e. of Slidell, *Harris s. n.* (FSU). MARYLAND: Anne Arundel Co.: Sandy ditches, *Taylor s. n.* (F). Prince George Co.: Laurel, *Karr s. n.* (US). Wicomico Co.: Salisbury, *Carter s. n.* (PH). Worcester Co.: Along side of ditch, Snow Hill, *Vandegrilt 7253* (NY). MISSISSIPPI: Choctaw Co.: French Camp, *Clute 58* (NY). Forrest Co.: Hattiesburg, *Woodson & Anderson 1514* (MO). Hancock Co.: Wet pine barrens, Bay St. Louis, *Demaree 31930* (NCU). Jackson Co.: Ocean Springs, *Pollard 1168* (MO, NY, US). NEW JERSEY: Camden Co.: Swampy ground, Lindenwood, *Meredith s. n.* (MO). Cape May Co.: Low ground, Cape May, *Parker s. n.* (NY) Ocean Co.: Cedar swamp, 10 mi w. of Barnegat, *Gleason & Smith 172* (NY). NEW YORK: Suffolk Co.: In bog, headwaters of Browns Creek, Patchogue, *Muenscher & Curtis 6224* (PH, NY, US). NORTH CAROLINA: Brunswick Co.: Ditch bank, margin of shrub bog, 5 mi. n. of Southport, *Godfrey 49168* (NSC). Johnston Co.: Savannah-like meadow near Smithfield, *Garner s. n.* (DUKE). Lincoln Co.: Boggy sandy margins and adjacent woods, e. of U.S. 321, *Bell s. n.* (NCU). Pamlico Co.: Pine savannah, 1.5 mi. s. of Reelsboro, *Radford 35935* (NCU). Sampson Co.: Flat pine-oak woods, 1.1 mi. w.s.w. of Newton Grove, *Ables & Haesloop 29946* (NCU). SOUTH CAROLINA: Beaufort Co.: Pine savannah, e. side of S. C. 170, *Bell 3826* (NCU). Florence Co.: Low ditch by pine savannah, 1.8 mi. w.s.w. of Hyman, *Bell 7557* (NCU). Georgetown Co.: Grass-sedge bog or savannah, 12 mi. n. of Georgetown, *Godfrey & Tryon 48* (F, PH, US). Saluda Co.: Open dry sandy pineland, Monetta, *Norton 348* (US). VIRGINIA: Isle of Wight Co.: Near Franklin, *Heller 912* (F, MO). James City Co.: Sandy soil in sphagnum-magnolia swamp, w. of Williamsburg, *Grimes 3854* (NY). Nansemond Co.: Mossy depressions in sandy pine barrens, near Cox Landing, *Smith & Hodgson 964* (DUKE, F, FLAS, FSU, GA, MO, NSC, NCU, US). Prince George Co.: Sandy pineland, s.w. of New Bohemia, *Wherry & Pennell 14423* (DUKE, MO, PH).

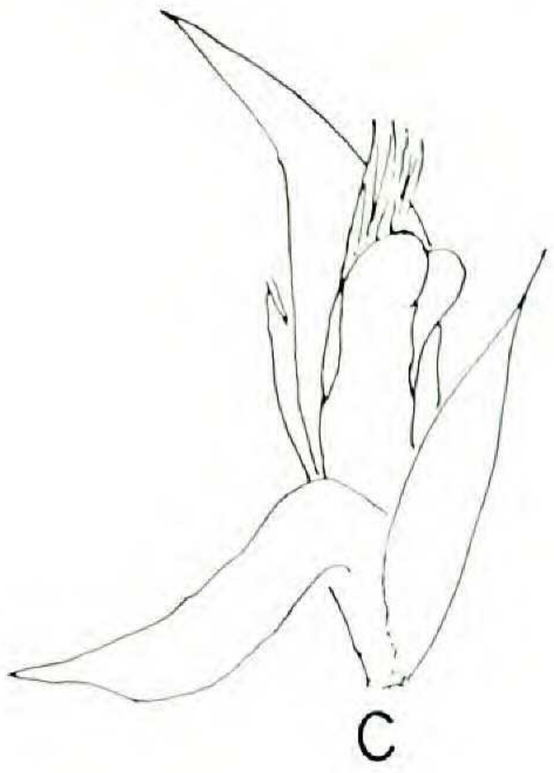
6. POLYGALA NANA (Michaux) DeCandolle, Prodr. 1:328. 1824. Fig. 8.

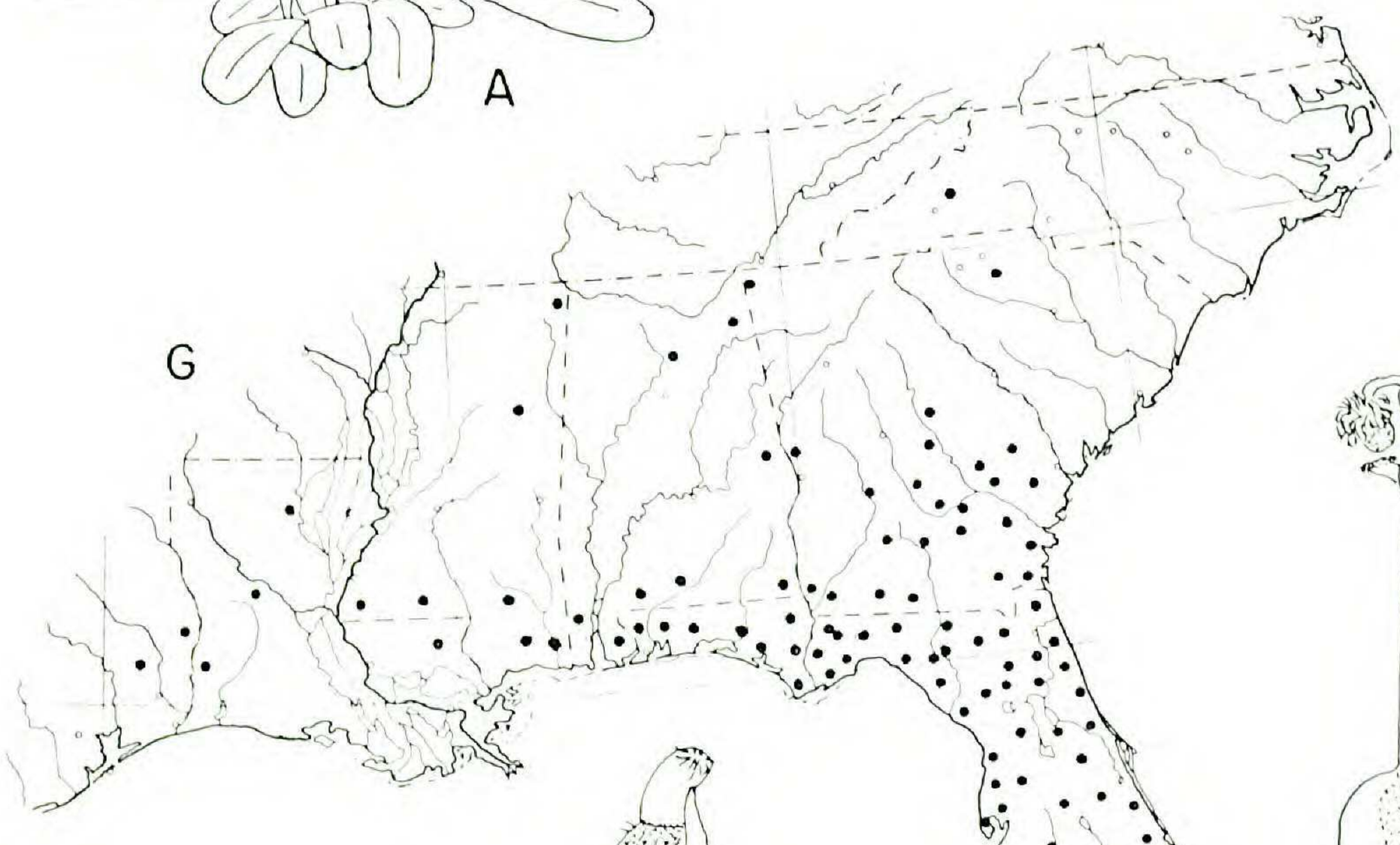
Polygala lutea L. var *nana* Michx., Fl. Bor. Am. 2:54. 1803.
TYPE: UNITED STATES: ? SOUTH CAROLINA: "in partis udis Carolinae," *A. Michaux* (HOLOTYPE: in Herbarium Michaux, Museum National d'Histoire Naturelle, Paris, not seen).
Pilostaxis nana (Michx.) Raf., New Fl. N. Am. 4:89. 1838; combination indicated also under *Polygala*, but not made.
Pilostaxis hyemalis Raf., New Fl. N. Am. 4:89. 1938; combination indicated also under *Polygala*, but not made.
Polygala nana (Michx.) DC. var. *humillima* Chod., Mem. Soc. Phys. Geneve 31 $(2)^2$:200. 1893.

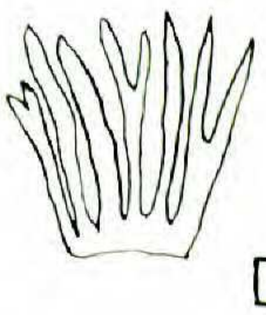
Annual or biennial, erect, 3-13 cm tall, stems unbranched, single to several from a definite tap-root, variable in height within same plant, often with one

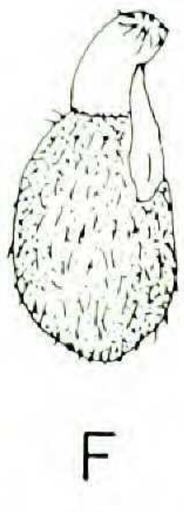
short inflorescence in center of basal rosette. Basal leaves 1.1-5.5 cm long, 0.4-2 cm broad, spatulate, rounded, occasionally apiculate, narrowed at base, 3- to 5-nerved, succulent, drying rugose; cauline leaves very few if present, oblanceolate. Inflorescence a head-like cylindric raceme, 1-3.8 cm long, 1-1.7 cm thick, extending above the basal leaves. Bracts 4.5-6.5 mm long, usually deciduous, sometimes persistent. Pedicels less than 1 mm long. Flowers lemon yellow to greenish-yellow, drying to green or yellowish-green. Upper sepaloid sepal 0.4 mm long, subulate-lanceolate; lower sepaloid sepals 3-











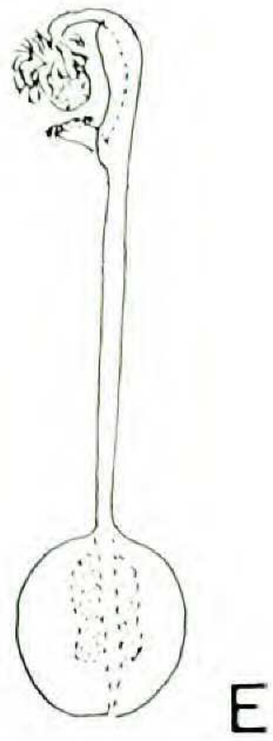


Figure 8. *Polygala nana*. A, habit × 1/3; B, petaloid sepal, flattened × 7; C, flower with petaloid sepal turned down, exposing petals × 5; D, crest on keel (lower petal) × 6; E, pistil, with pollen adhering to distal stigma × 13; F, seed × 15; G, distribution. (Drawn from fresh material, Alachua Co., Fla.)

5.3 mm long, lanceolate; wings 5.5-7.5 mm long, 1.8-2.8 mm broad, elliptic, 3- to 5-nerved, long-acuminate to cuspidate, involute at apex, sparsely ciliolate. Two upper petals 3.5-4 mm long; keel 3.5-5 mm long; crest with bifurcating lobes 2 mm long. Seed 0.8-1.6 mm long, pilose; rostrum thick, 0.2-0.5 mm long; aril ⅓ to full length of seed.

Anthesis: February through June; October.

Habitat and distribution: Sandy well-leached soil, in dry palmetto-pine flatwoods, longleaf pine—turkey oak or scrub oak communities, or in moist grassy areas; peninsular Florida north of Ft. Myers, northward inland to western North Carolina, westward to eastern Texas.

Polygala nana apparently cannot stand much competition. It is often in small sandy clearings where the rosettes may spread. When found on embankments it is usually observed on the drier upper slopes, often with *P. lutea* occurring on the moister soil below. In South Florida (Lee and Collier counties) this species approaches the habit of *P. smallii,* with the inflorescences scarcely exceeding the leaves [cf. *P. C. Standley 12751* (US)], but even in these populations the distinctions enumerated under *P. smallii* remain valid.

Representative specimens:

UNITED STATES: ALABAMA: Baldwin Co.: Gateswood, *Tracy 8683* (F, MO, NY, US). Covington Co.: Upland pine woodland, between Lockhart and Wing, *Godfrey & Harrison 55403* (FSU). Houston Co.: Open grassy area at roadside, 9 mi. s.s.e. of Hartford, *Hardin & Duncan 14867* (GA). Mobile Co.: Pine flatwoods swamp on Dauphin Island, *Lund 298* (FSU). FLORIDA: Alachua Co.: Moist ditchbank along Fla. 26, in slash-longleaf pine flatwoods between Gainesville and Newnan's Lake, *Ward 1277* (FLAS). Duval Co.: Dry fertile soil, near Jacksonville, *Curtiss 518* (F, NY). Franklin Co.: In dry soil along U.S. 98, 4.3 mi. e. of Gulf-Franklin Co. line, *Ward & Smith 2612* (FLAS). Lee Co.: Among palmettos, vicinity of Ft. Myers, *Standley 51* (F, US). Martin Co.: On bank of wet ditch, 0.4 mi. s. of St. Lucie Co. line, along U.S. 1, *Smith & Buchanan 125* (FLAS). Santa Rosa Co.: Wet sand, lowland, at Yellow River, Rd. 87, s.e. of Milton, *Hood 1935* (FLAS). GEORGIA: Brooks Co.: Dry pinewoods, 10 mi. w. of Quitman, *Pyron & McVaugh 2177* (GA). Camden Co.: Low pineland, 5 mi. n. of St. Mary, *Blanton 6334* (US). Dade Co.: Sandy soil of abandoned field, summit of Lookout Mt. near Little River, *McVaugh 9025* (GA, MO). Seminole Co.: Pinelands on Sealy's Plantation, southern tip of county, *Thorne & Muenscher 2428* (GA). Washington Co.: Low pineland, 1.5 mi. s. of Tennile, *Duncan 17514* (GA). LOUISIANA: Calcasieu Parish: Moist sandy loam in longleaf pinewoods, DeQuincy, *Pennell 10239* (NY). Natchitoches Parish: Sandy barrens, Chopin, Palmer 7339 (PH, US). Quachita Parish: On moist sandy clay of oak-pine woods, 3 mi. s. Luna, *Kral 8758* (FSU). St. Tammany Parish: In pine woods, Mandeville, *Langlois s. n.* (F). MISSISSIPPI: Forrest Co.: Hattiesburg, *Woodson & Anderson 1569* (MO). Harrison Co.: Low ground in pinewoods, Long Beach, *Joor s. n.* (MO). Jackson Co.: Ocean Springs, *Skehan 59* (F, MO, NCU). Oktibbeha Co.: Starkville, *Tracy s. n.* (US). Pike Co.: McComb, *Earle s. n.* (NY, MO). NORTH CAROLINA: Buncombe Co.: Asheville, *Seymour 91-8-19-31* (DUKE). SOUTH CAROLINA: Union Co.: Lumbered sandhill with seepage area containing pocasin plants, 0.4 mi. s. of Boiling Springs Church, *Duke & Ables 2230* (NCU). TEXAS: Hardin Co.: Moist open pinewoods, Silsbee, *Palmer 9565* (MO, US). Newton Co.: Newton, *Fisher 3473* (F).

7. POLYGALA **smallii** Smith & Ward, nom, nov. Fig. 9.

Polygala arenicola Small, N. Y. Bot. Gard. Bull. 3:426. 1905, nom. illeg., non *P. arenicola* Gürke in Baum, Kunene Sambesi Expedition 273. 1903. TYPE: UNITED STATES: FLORIDA: Dade County, "pine-

lands between Cocoanut Grove and Cutler," *J. K. Small & J. J. Carter 1276* (HOLOTYPE: NY!).

Pilostaxis arenicola (Small) Small, Man. S. E. Fl. 773. 1933.

Biennial, erect, 2.0-7.5 cm tall, with 1 (usually) to 4 or more short unbranched or branched stems from well-developed tap-root. Basal leaves 1-4.2 cm long, 0.2-1.4 cm broad, oblanceolate to linear-oblanceolate, rarely near-spatulate, often absent, or in irregular, crowded rosette; cauline leaves similar. Inflorescence a head-like, cylindric raceme, 0.4-3 cm long, 0.5-1.8 cm thick, usually surpassed by the basal leaves. Bracts to 3.5 mm long, deciduous. Pedicels less than 1 mm long. Flowers green or greenish-yellow, drying the same color. Sepaloid sepals 0.5 mm long, the upper lanceolate or lance-ovate, the lower linear-lanceolate; wings 5-8 mm long, 2-3 mm broad, oblong-lanceolate, 3- to 5-nerved, long-acuminate, remotely ciliolate. Upper petals 4-4.5 mm long; keel 4 mm long; crest with bifurcating lobes to 3 mm long. Seed 1.9-2.3 mm long, pilose; rostrum large, rounded, 0.6-0.7 long; aril ½ to almost length of seed.

Anthesis: March through May.

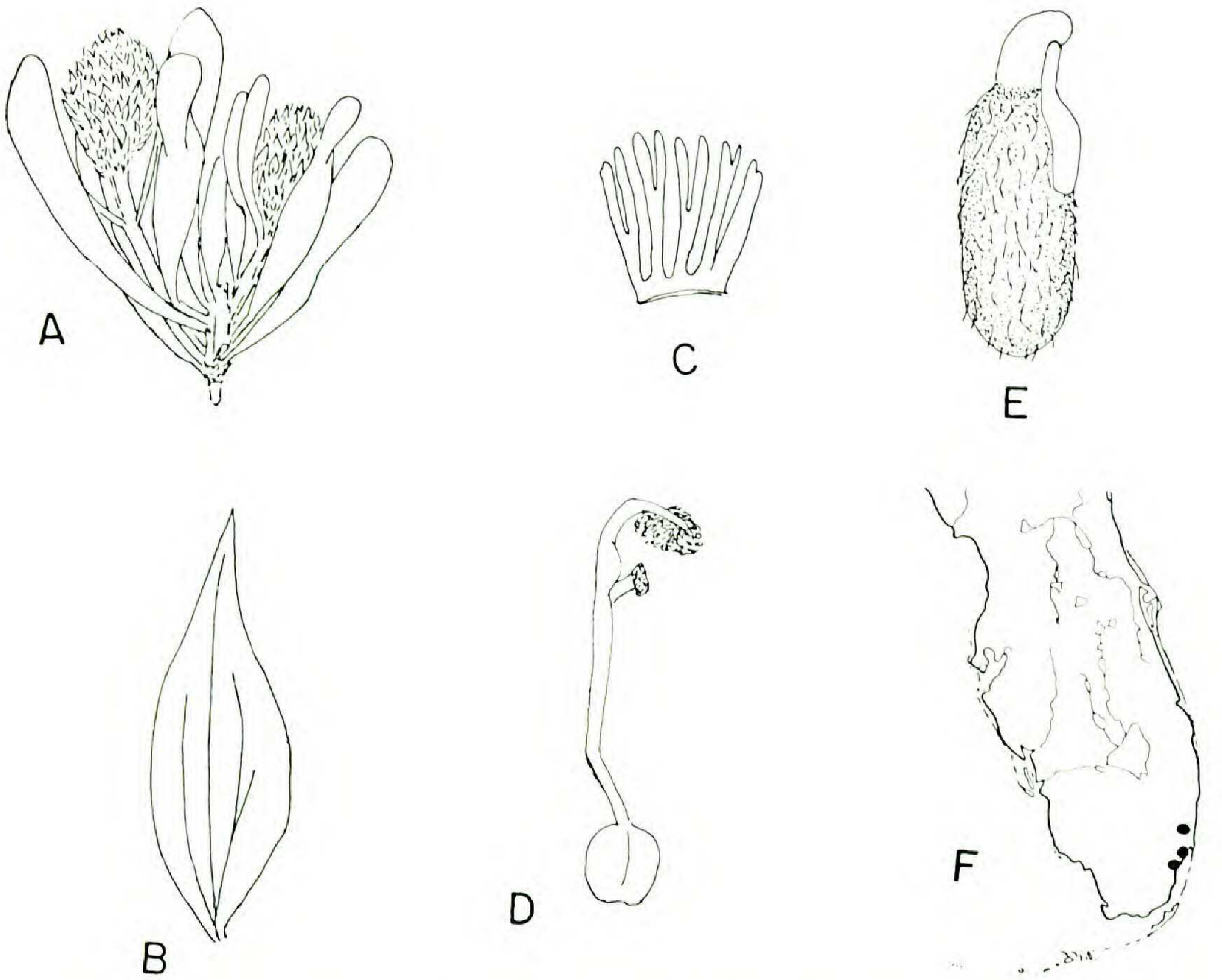


Figure 9. *Polygala smallii*. A, habit × ½; B, petaloid sepal, flattened × 7; C, crest on keel (lower petal) × 6; D, pistil × 12; E, seed × 15; F, distribution. (*Smith 755* [FLAS], Dade Co., Fla.)

Habitat and distribution: Sandy or calcareous rocky areas of the open grassy pinelands; endemic to South Florida (Broward and Dade counties).

Polygala smallii shares with *P. nana* the apparent inability to withstand competition and is characteristically found in small sandy openings in the dense herbaceous ground cover. It is clearly related to *P. nana* and has been relegated to that species by Blake (1924), Miller (1971), and Long & Lakela (1971). On close examination a number of consistent differences appear. The leaves of *P. smallii* are more lanceolate and much narrower, the wings are more lanceolate, the flowers are much greener at anthesis, and the length of the seeds is significantly greater. The most closely adjacent populations of the two species are separated by approximately 32 miles.

Small overlooked Gürke's detailed description in 1903 of a *Polygala* from southeastern Africa, under the name *P. arenicola,* rendering his later use of the epithet homonymous. Since Small's discovery of this species merits continued recognition, and since no conflict is created by its application to this most diminutive member of the series, it is here given the replacement name *Polygala smallii.*

Representative specimens:

UNITED STATES: FLORIDA: Broward Co.: In pinelands, Fort Lauderdale, *Small & Carter 1011* (NY). Dade Co.: Pinelands, Perrine, *Britton 149* (F, NY); Sandy pineland on corner of 26th Rd. and 3rd Ave. in Miami, *Eyles 8172* (NSC); Miami, *Garber s. n.* (FLAS, NY); Dry rocky soil, Miami, *Hood 72100* (FLAS); Miami, *Porter s. n.* (F); In dry open palmetto-pine flatwood, along Coral Reef Drive, South Miami, *Smith & Myint 755* (FLAS); Coconut Grove, *Peattie s. n.* (F); Pinelands about Arch Greek Prairie, *Small, Mosier & Small 6772* (NY, US); Pineland, Cutler, *Spink 106* (FLAS); *Woodbury s. n.* (BUS).

ACKNOWLEDGEMENTS

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